

# ***Operations Management***

## ***Chapter 8 – Location Strategies***

*PowerPoint presentation to accompany  
Heizer/Render  
Principles of Operations Management, 7e  
Operations Management, 9e*



# ***Outline***

- ☑ ***Global Company Profile:  
FedEx***
- ☑ ***The Strategic Importance of  
Location***

# ***Outline – Continued***

- ☑ ***Factors That Affect Location Decisions***
  - ☑ ***Labor Productivity***
  - ☑ ***Exchange Rates and Currency Risks***
  - ☑ ***Costs***
  - ☑ ***Political Risk, Values, and Culture***
  - ☑ ***Proximity to Markets***
  - ☑ ***Proximity to Suppliers***
  - ☑ ***Proximity to Competitors (Clustering)***

# ***Outline – Continued***

- Methods of Evaluating Location Alternatives***
  - The Factor-Rating Method***
  - Locational Break-Even Analysis***
  - Center-of-Gravity Method***
  - Transportation Model***

# ***Outline – Continued***

- Service Location Strategy***
  - How Hotel Chains Select Sites***
  - The Call Center Industry***
  - Geographic Information Systems***

# ***Learning Objectives***

***When you complete this chapter you should be able to:***

- 1. Identify and explain seven major factors that effect location decisions***
- 2. Compute labor productivity***
- 3. Apply the factor-rating method***
- 4. Complete a locational break-even analysis graphically and mathematically***
- 5. Use the center-of-gravity method***



# ***Federal Express***

- ☑ ***Central hub concept***

- ☑ ***Enables service to more locations with fewer aircraft***
- ☑ ***Enables matching of aircraft flights with package loads***
- ☑ ***Reduces mishandling and delay in transit because there is total control of packages from pickup to delivery***

# ***Location Strategy***

- ☑ ***One of the most important decisions a firm makes***
- ☑ ***Increasingly global in nature***
- ☑ ***Significant impact on fixed and variable costs***
- ☑ ***Decisions made relatively infrequently***
- ☑ ***The objective is to maximize the benefit of location to the firm***



# ***Location and Costs***

- Location decisions based on low cost require careful consideration***
- Once in place, location-related costs are fixed in place and difficult to reduce***
- Determining optimal facility location is a god investment***

# ***Location and Innovation***

- ☑ ***Cost is not always the most important aspect of a strategic decision***
- ☑ ***Four key attributes when strategy is based on innovation***
  - ☑ ***High-quality and specialized inputs***
  - ☑ ***An environment that encourages investment and local rivalry***
  - ☑ ***A sophisticated local market***
  - ☑ ***Local presence of related and supporting industries***

# ***Location Decisions***

- Long-term decisions***
- Decisions made infrequently***
- Decision greatly affects both fixed and variable costs***
- Once committed to a location, many resource and cost issues are difficult to change***

# ***Location Decisions***

## ***Country Decision***



**Figure 8.1**

## ***Critical Success Factors***

- 1. Political risks, government rules, attitudes, incentives***
- 2. Cultural and economic issues***
- 3. Location of markets***
- 4. Labor talent, attitudes, productivity, costs***
- 5. Availability of supplies, communications, energy***
- 6. Exchange rates and currency risks***

# Location Decisions

## Region/ Community Decision

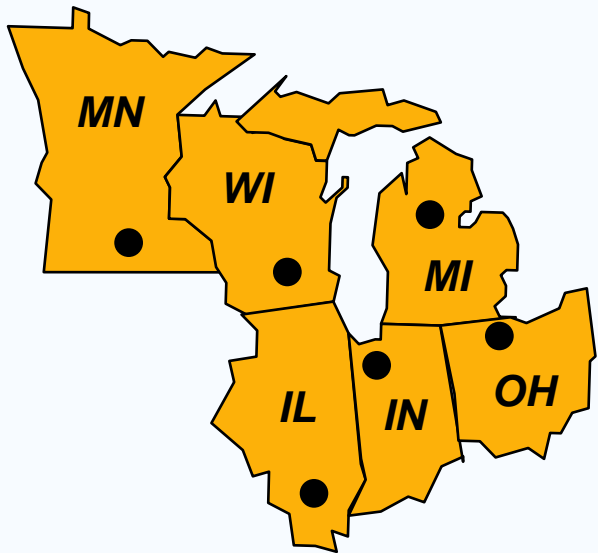


Figure 8.1

## Critical Success Factors

1. **Corporate desires**
2. **Attractiveness of region**
3. **Labor availability, costs, attitudes towards unions**
4. **Costs and availability of utilities**
5. **Environmental regulations**
6. **Government incentives and fiscal policies**
7. **Proximity to raw materials and customers**
8. **Land/construction costs**

# ***Location Decisions***

## ***Site Decision***



## ***Critical Success Factors***

- 1. Site size and cost***
- 2. Air, rail, highway, and waterway systems***
- 3. Zoning restrictions***
- 4. Proximity of services/ supplies needed***
- 5. Environmental impact issues***

**Figure 8.1**

# ***Growth Competitiveness Index of Countries***

<b><i>Country</i></b>	<b><i>2006-2007 Rank</i></b>	<b><i>2005 Rank</i></b>
<b><i>Switzerland</i></b>	<b><i>1</i></b>	<b><i>4</i></b>
<b><i>USA</i></b>	<b><i>6</i></b>	<b><i>1</i></b>
<b><i>Japan</i></b>	<b><i>7</i></b>	<b><i>10</i></b>
<b><i>Germany</i></b>	<b><i>8</i></b>	<b><i>6</i></b>
<b><i>UK</i></b>	<b><i>10</i></b>	<b><i>9</i></b>
<b><i>Israel</i></b>	<b><i>15</i></b>	<b><i>23</i></b>
<b><i>Canada</i></b>	<b><i>16</i></b>	<b><i>13</i></b>
<b><i>New Zealand</i></b>	<b><i>23</i></b>	<b><i>22</i></b>
<b><i>Italy</i></b>	<b><i>42</i></b>	<b><i>38</i></b>
<b><i>China</i></b>	<b><i>54</i></b>	<b><i>48</i></b>
<b><i>Mexico</i></b>	<b><i>58</i></b>	<b><i>59</i></b>
<b><i>Russia</i></b>	<b><i>62</i></b>	<b><i>53</i></b>

Table 8.1

# ***Factors That Affect Location Decisions***

- ☑ ***Labor productivity***
  - ☑ ***Wage rates are not the only cost***
  - ☑ ***Lower productivity may increase total cost***

$$\frac{\text{Labor cost per day}}{\text{Productivity (units per day)}} = \text{Cost per unit}$$

***Connecticut***

$$\frac{\$70}{60 \text{ units}} = \$1.17 \text{ per unit}$$

***Juarez***

$$\frac{\$25}{20 \text{ units}} = \$1.25 \text{ per unit}$$



# ***Factors That Affect Location Decisions***

- ☑ ***Exchange rates and currency risks***
  - ☑ ***Can have a significant impact on cost structure***
  - ☑ ***Rates change over time***
- ☑ ***Costs***
  - ☑ ***Tangible - easily measured costs such as utilities, labor, materials, taxes***
  - ☑ ***Intangible - less easy to quantify and include education, public transportation, community, quality-of-life***

# ***Factors That Affect Location Decisions***

## ***Exchange rates and currency risks***

***Can have a significant impact on the cost structure***

***Rates change over time***

## ***Costs***

***Tangible - e.g., real estate, utilities, labor***

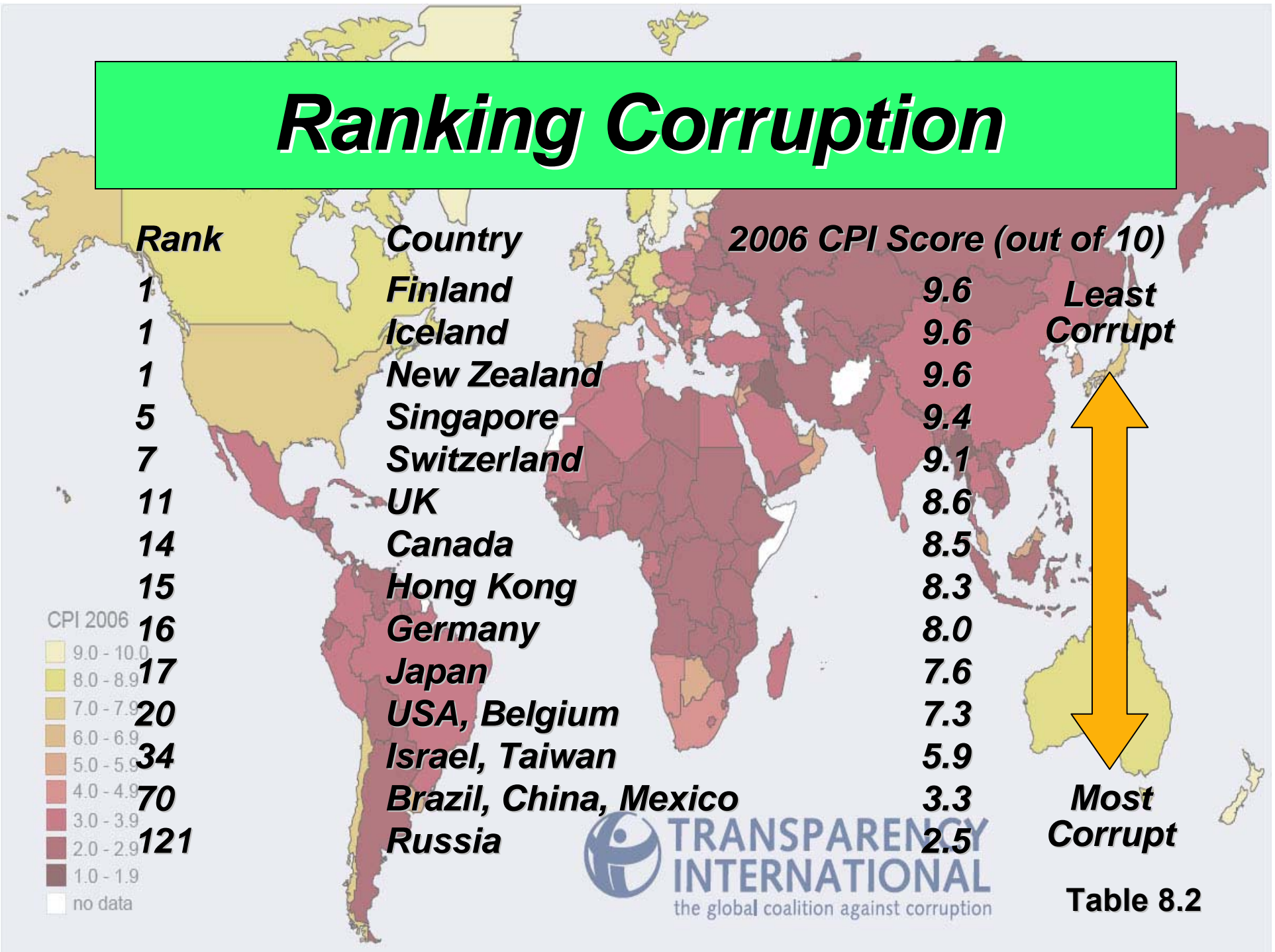
***Intangible - e.g., taxes, infrastructure, include education, public transportation, community, quality-of-life***

***Location decisions based on costs alone can create difficult ethical situations***

# ***Factors That Affect Location Decisions***

- ☑ ***Political risk, values, and culture***
  - ☑ ***National, state, local governments attitudes toward private and intellectual property, zoning, pollution, employment stability may be in flux***
  - ☑ ***Worker attitudes towards turnover, unions, absenteeism***
  - ☑ ***Globally cultures have different attitudes towards punctuality, legal, and ethical issues***

# Ranking Corruption



# ***Factors That Affect Location Decisions***

- ☑ ***Proximity to markets***
  - ☑ ***Very important to services***
  - ☑ ***JIT systems or high transportation costs may make it important to manufacturers***
- ☑ ***Proximity to suppliers***
  - ☑ ***Perishable goods, high transportation costs, bulky products***

# ***Factors That Affect Location Decisions***

- ☑ ***Proximity to competitors***
  - ☑ ***Called clustering***
  - ☑ ***Often driven by resources such as natural, information, capital, talent***
  - ☑ ***Found in both manufacturing and service industries***

# ***Clustering of Companies***

<b><i>Industry</i></b>	<b><i>Locations</i></b>	<b><i>Reason for clustering</i></b>
<b><i>Wine making</i></b>	<b><i>Napa Valley (US) Bordeaux region (France)</i></b>	<b><i>Natural resources of land and climate</i></b>
<b><i>Software firms</i></b>	<b><i>Silicon Valley, Boston, Bangalore (India)</i></b>	<b><i>Talent resources of bright graduates in scientific/technical areas, venture capitalists nearby</i></b>
<b><i>Race car builders</i></b>	<b><i>Huntington/North Hampton region (England)</i></b>	<b><i>Critical mass of talent and information</i></b>

**Table 8.3**

# ***Clustering of Companies***

<b><i>Industry</i></b>	<b><i>Locations</i></b>	<b><i>Reason for clustering</i></b>
<b><i>Theme parks (Disney World, Universal Studios)</i></b>	<b><i>Orlando, Florida</i></b>	<b><i>A hot spot for entertainment, warm weather, tourists, and inexpensive labor</i></b>
<b><i>Electronics firms</i></b>	<b><i>Northern Mexico</i></b>	<b><i>NAFTA, duty free export to US</i></b>
<b><i>Computer hardware manufacturers</i></b>	<b><i>Singapore, Taiwan</i></b>	<b><i>High technological penetration rate and per capita GDP, skilled/educated workforce with large pool of engineers</i></b>

**Table 8.3**



# ***Clustering of Companies***

<b><i>Industry</i></b>	<b><i>Locations</i></b>	<b><i>Reason for clustering</i></b>
<b><i>Fast food chains (Wendy's, McDonald's, Burger King, and Pizza Hut)</i></b>	<b><i>Sites within 1 mile of each other</i></b>	<b><i>Stimulate food sales, high traffic flows</i></b>
<b><i>General aviation aircraft (Cessna, Learjet, Boeing)</i></b>	<b><i>Wichita, Kansas</i></b>	<b><i>Mass of aviation skills</i></b>
<b><i>Orthopedic devices</i></b>	<b><i>Warsaw, Indiana</i></b>	<b><i>Ready supply of skilled workers, strong U.S. market</i></b>

**Table 8.3**

# ***Factor-Rating Method***

- ☑ ***Popular because a wide variety of factors can be included in the analysis***
- ☑ ***Six steps in the method***
  1. ***Develop a list of relevant factors called critical success factors***
  2. ***Assign a weight to each factor***
  3. ***Develop a scale for each factor***
  4. ***Score each location for each factor***
  5. ***Multiply score by weights for each factor for each location***
  6. ***Recommend the location with the highest point score***

# Factor-Rating Example

<b>Critical Success Factor</b>	<b>Weight</b>	<b>Scores (out of 100)</b>		<b>Weighted Scores</b>	
		<b>France</b>	<b>Denmark</b>	<b>France</b>	<b>Denmark</b>
<b>Labor availability and attitude</b>	<b>.25</b>	<b>70</b>	<b>60</b>	<b><math>(.25)(70) = 17.5</math></b>	<b><math>(.25)(60) = 15.0</math></b>
<b>People-to-car ratio</b>	<b>.05</b>	<b>50</b>	<b>60</b>	<b><math>(.05)(50) = 2.5</math></b>	<b><math>(.05)(60) = 3.0</math></b>
<b>Per capita income</b>	<b>.10</b>	<b>85</b>	<b>80</b>	<b><math>(.10)(85) = 8.5</math></b>	<b><math>(.10)(80) = 8.0</math></b>
<b>Tax structure</b>	<b>.39</b>	<b>75</b>	<b>70</b>	<b><math>(.39)(75) = 29.3</math></b>	<b><math>(.39)(70) = 27.3</math></b>
<b>Education and health</b>	<b>.21</b>	<b>60</b>	<b>70</b>	<b><math>(.21)(60) = 12.6</math></b>	<b><math>(.21)(70) = 14.7</math></b>
<b>Totals</b>	<b><u>1.00</u></b>			<b><u>70.4</u></b>	<b><u>68.0</u></b>

Table 8.4

# ***Locational Break-Even Analysis***

- Method of cost-volume analysis used for industrial locations***
- Three steps in the method***
  - 1. Determine fixed and variable costs for each location***
  - 2. Plot the cost for each location***
  - 3. Select location with lowest total cost for expected production volume***

# ***Locational Break-Even Analysis Example***

***Three locations:***

***Selling price = \$120***

***Expected volume = 2,000 units***

<b><i>City</i></b>	<b><i>Fixed Cost</i></b>	<b><i>Variable Cost</i></b>	<b><i>Total Cost</i></b>
<b><i>Akron</i></b>	<b><i>\$30,000</i></b>	<b><i>\$75</i></b>	<b><i>\$180,000</i></b>
<b><i>Bowling Green</i></b>	<b><i>\$60,000</i></b>	<b><i>\$45</i></b>	<b><i>\$150,000</i></b>
<b><i>Chicago</i></b>	<b><i>\$110,000</i></b>	<b><i>\$25</i></b>	<b><i>\$160,000</i></b>

***Total Cost = Fixed Cost + (Variable Cost x Volume)***

# Locational Break-Even Analysis Example

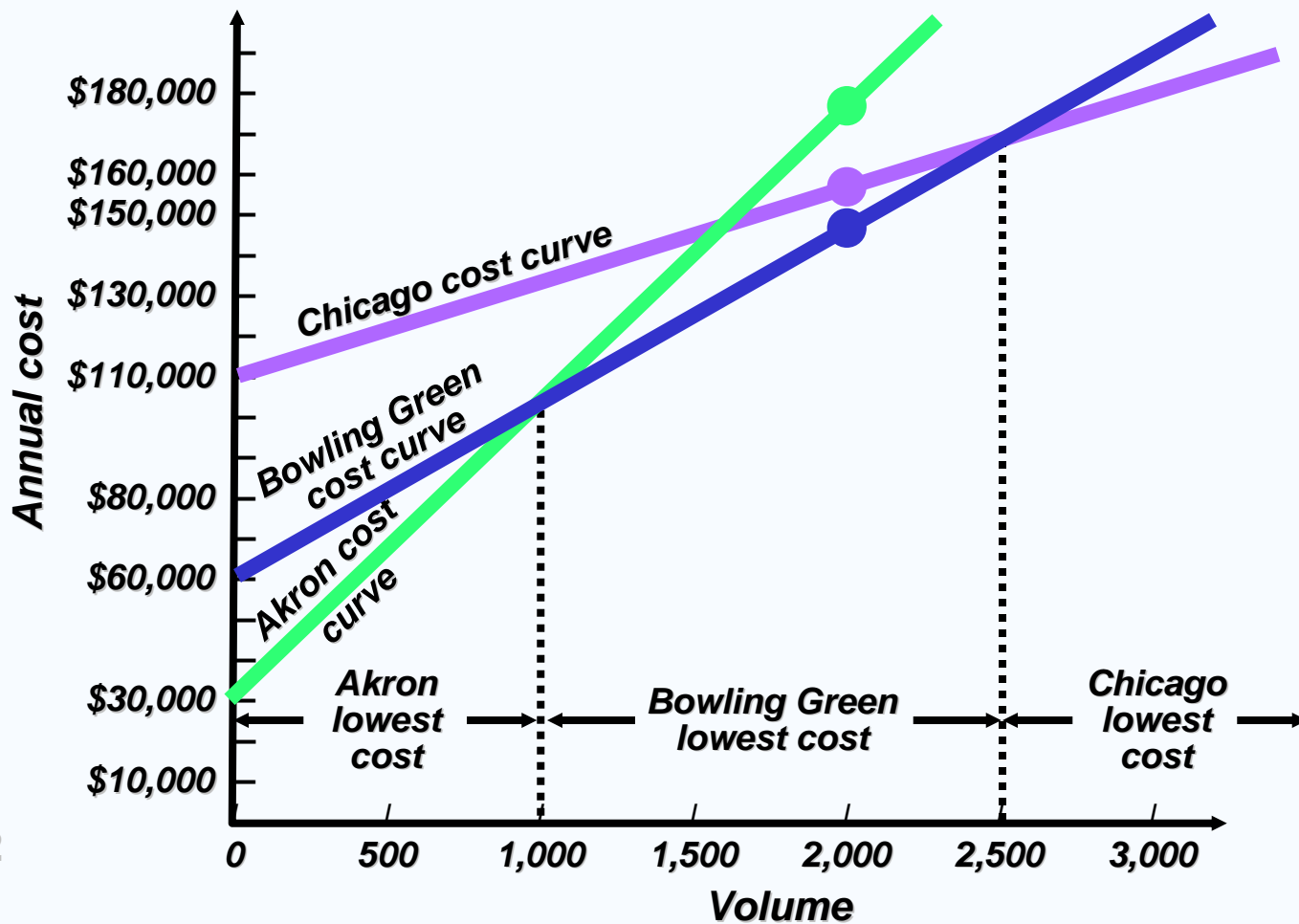


Figure 8.2

# ***Center-of-Gravity Method***

- Finds location of distribution center that minimizes distribution costs***
- Considers***
  - Location of markets***
  - Volume of goods shipped to those markets***
  - Shipping cost (or distance)***

# ***Center-of-Gravity Method***

- Place existing locations on a coordinate grid***
  - Grid origin and scale is arbitrary***
  - Maintain relative distances***
- Calculate X and Y coordinates for 'center of gravity'***
  - Assumes cost is directly proportional to distance and volume shipped***



# ***Center-of-Gravity Method***

$$**x - coordinate = \frac{\sum_i d_{ix} Q_i}{\sum_i Q_i}**$$

$$**y - coordinate = \frac{\sum_i d_{iy} Q_i}{\sum_i Q_i}**$$

**where**

- $d_{ix}$  = x-coordinate of location  $i$**
- $d_{iy}$  = y-coordinate of location  $i$**
- $Q_i$  = Quantity of goods moved to or from location  $i$**

# Center-of-Gravity Method

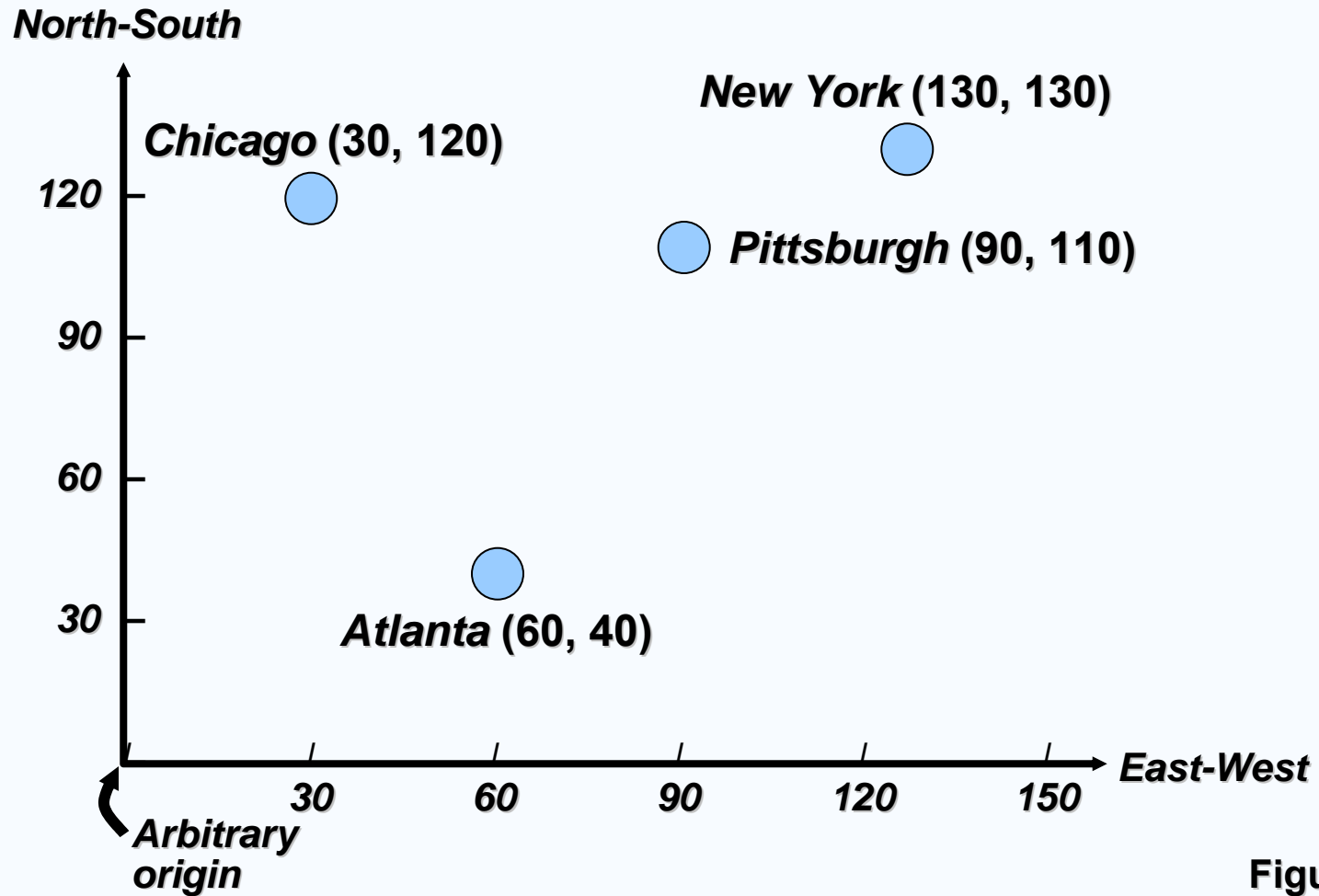


Figure 8.3

# Center-of-Gravity Method

<i>Store Location</i>	<i>Number of Containers Shipped per Month</i>
<b>Chicago (30, 120)</b>	<b>2,000</b>
<b>Pittsburgh (90, 110)</b>	<b>1,000</b>
<b>New York (130, 130)</b>	<b>1,000</b>
<b>Atlanta (60, 40)</b>	<b>2,000</b>

$$\begin{aligned}x\text{-coordinate} &= \frac{(30)(2000) + (90)(1000) + (130)(1000) + (60)(2000)}{2000 + 1000 + 1000 + 2000} \\ &= 66.7\end{aligned}$$

$$\begin{aligned}y\text{-coordinate} &= \frac{(120)(2000) + (110)(1000) + (130)(1000) + (40)(2000)}{2000 + 1000 + 1000 + 2000} \\ &= 93.3\end{aligned}$$

# Center-of-Gravity Method

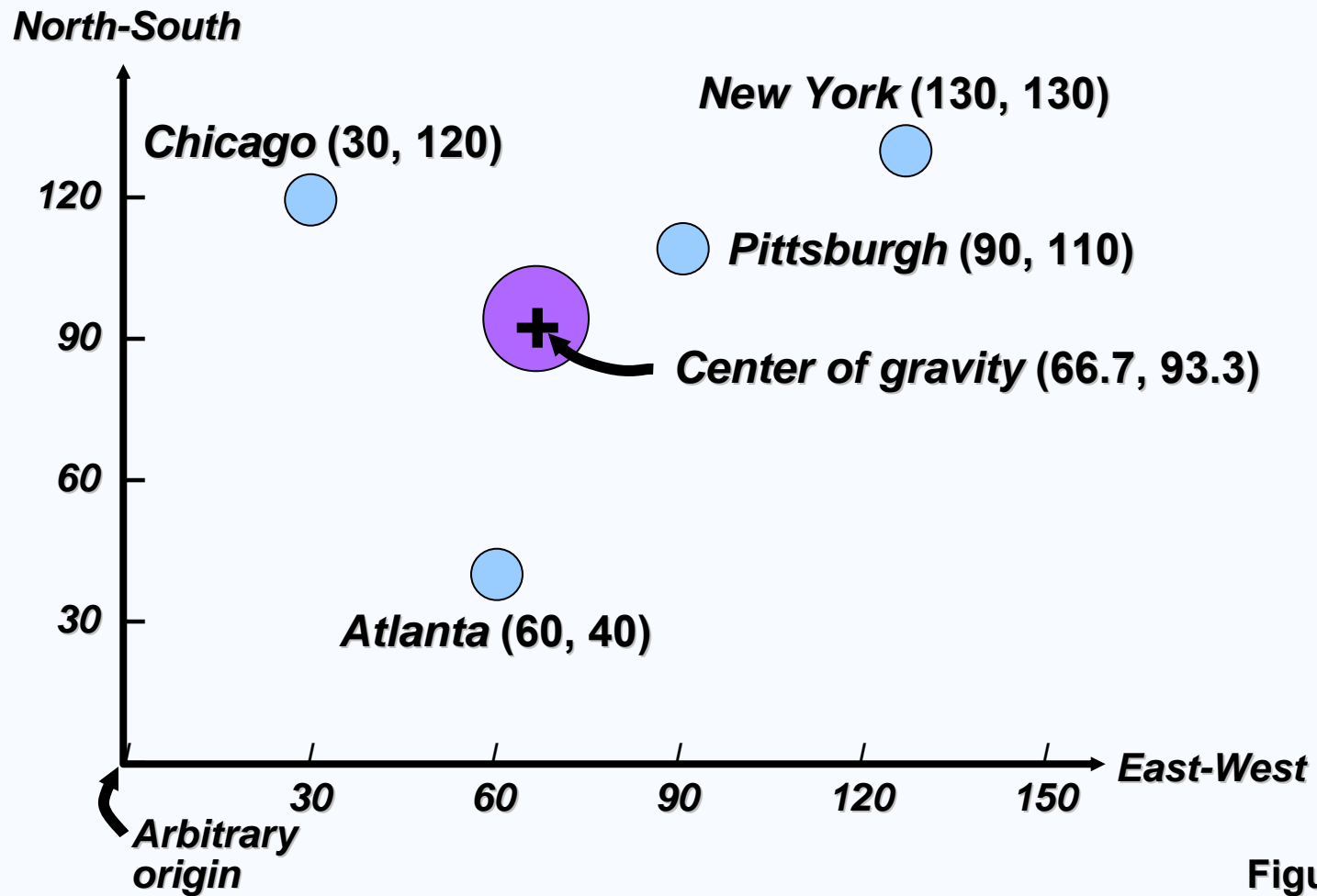


Figure 8.3

# ***Transportation Model***

- Finds amount to be shipped from several points of supply to several points of demand***
- Solution will minimize total production and shipping costs***
- A special class of linear programming problems***

# Worldwide Distribution of Volkswagens and Parts

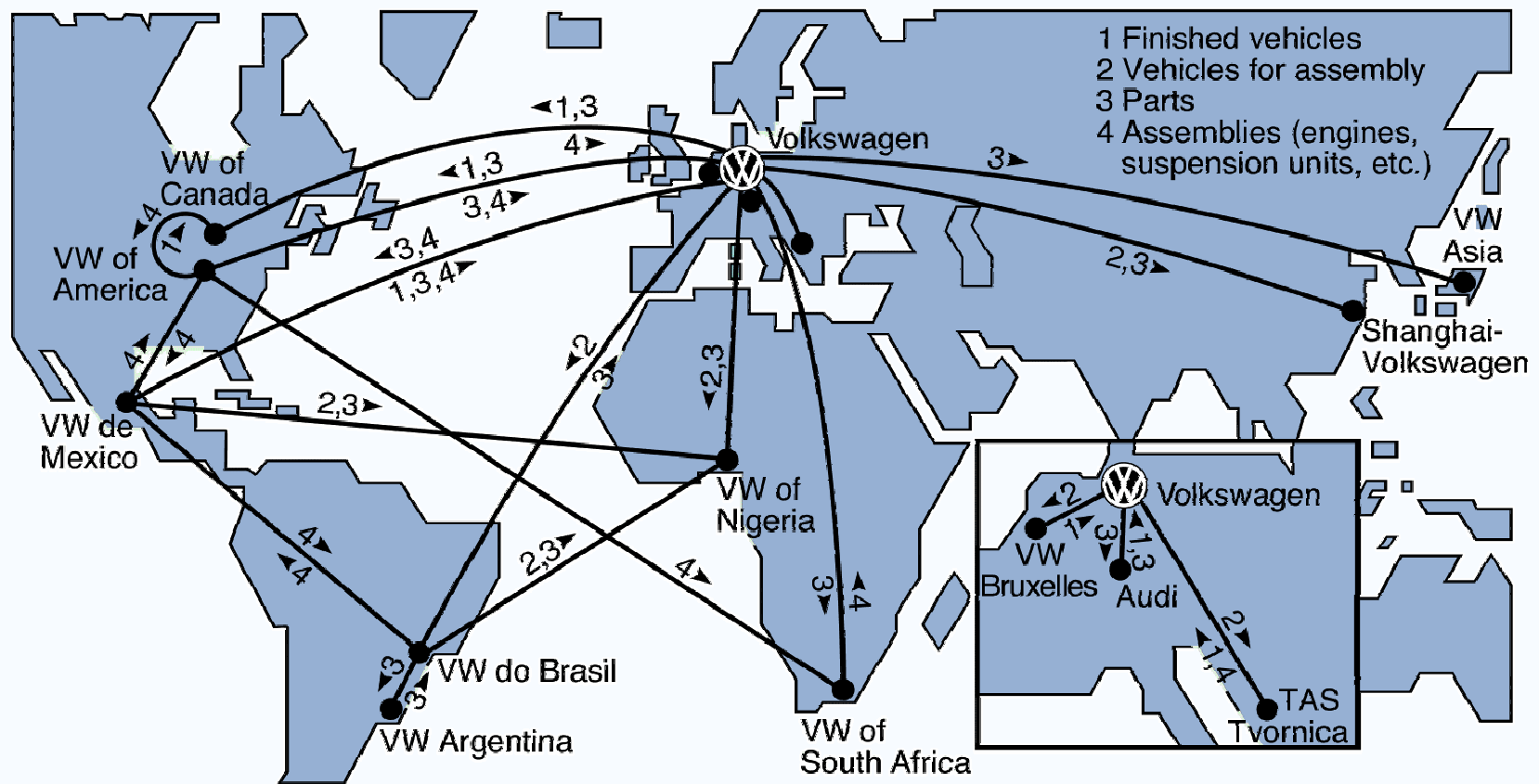


Figure 8.4

# ***Service Location Strategy***

- 1. Purchasing power of customer-drawing area***
- 2. Service and image compatibility with demographics of the customer-drawing area***
- 3. Competition in the area***
- 4. Quality of the competition***
- 5. Uniqueness of the firm's and competitors' locations***
- 6. Physical qualities of facilities and neighboring businesses***
- 7. Operating policies of the firm***
- 8. Quality of management***

# Location Strategies

<i>Service/Retail/Professional Location</i>	<i>Goods-Producing Location</i>
<i>Revenue Focus</i>	<i>Cost Focus</i>
<p><b>Volume/revenue</b></p> <ul style="list-style-type: none"> <li><i>Drawing area; purchasing power</i></li> <li><i>Competition; advertising/pricing</i></li> </ul> <p><b>Physical quality</b></p> <ul style="list-style-type: none"> <li><i>Parking/access; security/lighting; appearance/image</i></li> </ul> <p><b>Cost determinants</b></p> <ul style="list-style-type: none"> <li><i>Rent</i></li> <li><i>Management caliber</i></li> <li><i>Operations policies (hours, wage rates)</i></li> </ul>	<p><b>Tangible costs</b></p> <ul style="list-style-type: none"> <li><i>Transportation cost of raw material</i></li> <li><i>Shipment cost of finished goods</i></li> <li><i>Energy and utility cost; labor; raw material; taxes, and so on</i></li> </ul> <p><b>Intangible and future costs</b></p> <ul style="list-style-type: none"> <li><i>Attitude toward union</i></li> <li><i>Quality of life</i></li> <li><i>Education expenditures by state</i></li> <li><i>Quality of state and local government</i></li> </ul>

Table 8.6



# Location Strategies

<i>Service/Retail/Professional Location</i>	<i>Goods-Producing Location</i>
<i>Techniques</i>	<i>Techniques</i>
<i>Regression models to determine importance of various factors</i> <i>Factor-rating method</i> <i>Traffic counts</i> <i>Demographic analysis of drawing area</i> <i>Purchasing power analysis of area</i> <i>Center-of-gravity method</i> <i>Geographic information systems</i>	<i>Transportation method</i> <i>Factor-rating method</i> <i>Locational break-even analysis</i> <i>Crossover charts</i>

**Table 8.6**

# Location Strategies

<b><i>Service/Retail/Professional Location</i></b>	<b><i>Goods-Producing Location</i></b>
<b><i>Assumptions</i></b>	<b><i>Assumptions</i></b>
<b><i>Location is a major determinant of revenue</i></b>	<b><i>Location is a major determinant of cost</i></b>
<b><i>High customer-contact issues are critical</i></b>	<b><i>Most major costs can be identified explicitly for each site</i></b>
<b><i>Costs are relatively constant for a given area; therefore, the revenue function is critical</i></b>	<b><i>Low customer contact allows focus on the identifiable costs</i></b>
	<b><i>Intangible costs can be evaluated</i></b>

**Table 8.6**

# ***How Hotel Chains Select Sites***

- ☑ ***Location is a strategically important decision in the hospitality industry***
- ☑ ***La Quinta started with 35 independent variables and worked to refine a regression model to predict profitability***
- ☑ ***The final model had only four variables***
  - ☑ ***Price of the inn***
  - ☑ ***Median income levels***
  - ☑ ***State population per inn***
  - ☑ ***Location of nearby colleges***

**$r^2 = .51$**   
***51% of the profitability is predicted by just these four variables!***

# ***The Call Center Industry***

- Requires neither face-to-face contact nor movement of materials***
- Has very broad location options***
- Traditional variables are no longer relevant***
- Cost and availability of labor may drive location decisions***

# ***Geographic Information Systems (GIS)***

- Important tool to help in location analysis***
- Enables more complex demographic analysis***
- Available data bases include***
  - Detailed census data***
  - Detailed maps***
  - Utilities***
  - Geographic features***
  - Locations of major services***

# Geographic Information Systems (GIS)

